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ON THE CLASSIFICATION OF BRAZILIAN CULICIDAE WITH
SPECIAL REFERENCE TO THOSE CAPABLE OF
HARBORING THE YELLOW FEVER VIRUS.¹

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Rockefeller Foundation, at Bahia, Brazil.)

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I. INTRODUCTION.

Experiments carried on in the yellow fever laboratory at Bahia during the last two years (1929-1930, Davis and Shannon) indicate that the Brazilian species of Culicidae which are capable of harboring the yellow fever virus for periods of time longer than the usual incubation period in stegomyia all belong to a single tribe, the Culicini, and further that this condition is restricted to certain genera within the tribe, namely: *Psorophora*, *Aedes*, and *Mansonia*.

The only other species of the tribe Culicini which annoy man to any great extent belong to the genus *Culex*, and of these, *C. quinquefasciatus* is the chief offender in the tropics. However, experiments conducted on this species have shown it to be at least a highly unfavorable host for the virus of yellow fever.

In connection with these observations, it is of interest to note that the species of the genus *Culex* are considered to have been, originally, feeders on avian blood. (It would appear that *C. quinquefasciatus* has retained this instinct to a large extent,

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since it feeds upon birds with the same alacrity as it feeds upon man.) On the other hand, the species of *Psorophora*, *Aedes*, and *Mansonia* feed primarily on mammalian blood.

Of the other tropical American genera belonging to the tribe Culicini, namely, *Haemagogus*, *Aedomyia*, *Orthopodomyia*, *Lutzia*, and *Deinocerites*, it is probable that only the first, because of its close relation to *Aedes*, will be found capable of harboring the yellow fever virus for an appreciable length of time. *Aedomyia* rarely attacks mammalian hosts; in fact, the evidence at present available indicates that it prefers avian blood. The species of *Orthopodomyia* and *Lutzia* are not known to attack men. *Deinocerites*, a crab-hole breeding species confined to the Caribbean coast region, attacks man rather rarely. As this genus is directly derived from the genus *Culex*, it is probable that it likewise can not harbor the yellow fever virus. *Culicella*, the only other Culicine genus occurring in America, is confined strictly to temperate regions.

A number of experiments made on species belonging to the Sabethine and Anopheline tribes, indicate that these mosquitoes are unfavorable hosts for the virus. The tribe Megarhinini may be entirely disregarded, as it contains no blood-sucking members; while the Uranotaeniini attack man with extreme rarity.

The foregoing observations are in accord with those made in the yellow fever laboratory at Lagos, Nigeria, with but one exception. Successful transmission of yellow fever by means of biting was obtained there with a number of species of the genus *Aedes* and with *Mansonia africanus*. *Eretmopodites chrysogaster*, a derivative of the genus *Aedes*, proved to be a favorable host for the virus. The exception mentioned occurred in the case of a species of *Culex*, namely, *C. thalassius*. Infection was obtained by injecting specimens of this species after an "adequate" incubation period. (Bauer, 1928; Philip, 1929, 1930.)

Although the primary object of the present paper is to give a revision of the Brazilian species belonging to the genera *Psorophora*, *Aedes*, and *Mansonia*, it is considered advisable, for purposes of orientation, to include a classification of the tribes and genera of the subfamily Culicini (Brazilian) as a whole.

Experience has shown that the key to the American tribes and genera proposed by Dyar and Shannon (1924), a modification of that proposed by Edwards (1922), is unsuitable except for the specialist. Most of the characters used in it are very minute and difficult of detection; whereas some of the really obvious characters are omitted. The reason for this course was that the more obvious characters are frequently not absolute and are usually applicable only to the female sex, whereas the characters used appeared to be absolute and common to both

sexes. However, many of the less absolute and uni-sexual characters can be of material assistance in the classification of the tribes and genera, especially since, as a matter of fact, it is specimens of the female sex that are more commonly collected; and even in the cases where males are obtained, as by rearing, females as well are incidentally procured.

It has been more or less customary in the past to avoid using characters based on the scales for tribal and generic distinctions, evidently because of the belief that such characters are too plastic and therefore do not possess generic or tribal value. However, the general appearance of the insects is largely dependent upon the development and color of the scales, and the use of scale characters will doubtless prove of value even in generic and tribal keys. In fact, at least as far as the American mosquitoes are concerned, one of the most absolute characters (which is also easy of discernment) for separating the tribe Anophelini from all other tribes, is based on scales.

In the key here presented, therefore, an attempt has been made to include all of the characters, whether absolute or not, which may prove of value in classification. The more obvious characters, frequently possessed only by the female, are in bold face type. Thus for preliminary and rapid identification only the characters given in bold face type need be considered.

All the tribes and all but two of the genera found in America occur in Brazil. Although the key has been prepared primarily for the identification of the Brazilian fauna, the two genera not found here (*Culiseta* and *Deinocerites*) are also included for the sake of completeness.

The fact that the key has been based primarily on Brazilian mosquitoes makes it possible to emphasize certain characters for the separation of the three genera, *Psorophora*, *Aedes*, and *Mansonia*, which are probably the only Brazilian genera that have any important relation to yellow fever. Thus, although the nature of the wing scales easily distinguishes the species of *Mansonia* from those of the Brazilian species of *Aedes*, there are two North American *Aedines* (*grossbecki* and *squamiger*) which also have large wing scales. However, these two may be easily distinguished from *Mansonia* by the uniformly black proboscis and by the scales on the mesopleura (preanepisternum), characters obviously more easily apprehended than the presence or absence of setae on the stem vein, the character formerly utilized by Dyar and Shannon.

Certain characters, apparently not before used in mosquito taxonomy, are also included in the key. One of these is concerned with the separation of the Anophelini on the basis of the absence of scales on the first abdominal tergite. It is evidently a character of tribal value, as shown by the following discussion.

II. RELATION BETWEEN THE HABITS OF THE ADULTS AND THEIR EXTERNAL CHARACTERS.

Inasmuch as habits influence the development of characters, or vice versa, a knowledge of one is of assistance in understanding the other.

The family Culicidae probably developed from a type possessing a short proboscis (i.e. shorter than the head); five segmented, pendulous palpi which exceeded the length of the proboscis; and a simple vestiture of fine hairs on the head, body, legs, and wing veins.

These primitive features are still retained by one subfamily of the Culicidae, the Dixinae, while the only important departure shown by the Chaoborinae is the scale-like development of the vestiture of the wing veins.

All the species of the subfamily Culicinae, however, have the greatly elongated proboscis and the palpi more or less straight and directed forward, exceeding the length of the proboscis only in the male sex of certain species; the males frequently also have the apical segments directed upward. All these species have a more or less well developed vestiture of scales on the occiput, body, and wing veins. The subgenus *Stethomyia* (*Anopheles*) is probably the nearest approach to the primitive type among the American mosquitoes as regards vestiture; the proboscis and palpi are greatly elongated and approximate in length, which no doubt was the condition existing in the progenitors of the Culicinae, or true mosquitoes.

The extreme departure from the *Stethomyia* type is found in the species of the genus *Sabethes*: proboscis long and slender; palpus with but a single, forward directed segment far shorter than the proboscis; the hairs of the head and body and wing veins almost entirely replaced by broad flat scales, mostly of a deep metallic coloration; and a remarkable development of scales on the legs, forming broad, blade-like structures.

The habits probably most responsible for the development or modification of adult characters are: (1) food habits; (2) time of activity; (3) modes of concealment; (4) methods of attack; (5) mating attitudes.

The subject is necessarily an involved one, and therefore attention can be drawn to but few of the outstanding features. Incidentally, it may be that because the female has undergone greater changes in habits than the male, she has also been the more completely modified structurally; while the male still retains more or less completely many of the primitive features.

(1) FOOD HABITS.

The more tangible modifications have taken place in the mouth parts (clypeus, palpi, and proboscis), flight ability, and

mode of attack (e.g., contrast the methods of stegomyia, *Mansonia*, and *Wyeomyia* species), and probably certain modifications of the legs and claws.

Modifications of the mouth parts.—Probably all the Brazilian Culicines, except *Megarhinus*, *Lutzia*, and possibly *Orthopodomyia* and some species of *Culex*, suck blood.

It is apparent, however, that the blood-sucking instinct is not equally developed in all the blood-sucking species. These differences in food habits no doubt have brought about some of the modifications of the mouth parts which are discussed below.

(a) *The proboscis.*

The proboscis is straight in all mosquitoes except those of the genus *Megarhinus* and certain species of *Wyeomyia* (subgenera *Dodecamyia* and *Dyarina*). The latter are blood-sucking and probably feed on flowers as well. The former feed only on flowers and probably on honey dew, and the proboscis is peculiarly modified accordingly. The basal portion is rigid and stout but tapers outwardly, forming a slender downward-curved organ. However, the curved portion is very flexible during life and can be straightened and turned with the greatest ease when the insect is searching for food or water.

In most of the other Culicines the proboscis is of remarkable uniformity; it varies little as a rule in length and girth, and only in certain groups and species are definite markings present.

(b) *The palpi.*

Originally, these structures were probably elongated and straightened to serve as a protection for the long, slender proboscis. At least it would appear that the elongated condition of the palpi was the primitive one for the group. This condition prevailed in practically all Anophelines (a recently described Old World species of Anophelini, *Brugella travestitus* Brug., has very short palpi in both sexes, *vide* Edwards, 1930). Long palpi, which not infrequently exceed the length of the proboscis, also occur in all males of *Megarhinus*, in the majority of the Culicini, and in a few species of the Sabethini (all *Joblotia* and certain species of *Goeldia*). The palpi are very short in the tribe Uranotaeniini and in all other Sabethines; moderately short or very short in *Aedeomyia*, and in certain species of *Haemagogus*, *Aedes*, and *Culex* (Culicini).

In the females (except the Anophelines) the palpi present a wide range of variation. Not only are they reduced in length (usually considerably), but also in the number of segments. Fusion appears to take place chiefly at the base of the organs, but it is apparent in some cases that the apical segment or segments have disappeared.

It is possible that the variation results from differences in mode of attack or of feeding. However, during the act of feeding, the palpi are directed upward, and when the proboscis is deeply imbedded, the palpi are at right angles to the proboscis. This condition is common to *Anopheles*, *Mansonia*, *Aedes*, and *Culex*, and probably to all other genera as well.

In length of palpi, the species of *Megarhinus* present an intermediate condition between the long and the short types. The palpi may be nearly as long (subgenus *Ankylorhynchus*) or two-thirds as long (subgenus *Megarhinus*) as the proboscis, but always exceed the antennae in length. The females of both subgenera show only three large, distinct segments (four in the male, the basal segment being fused with the one following). The reduction in this case has occurred at the terminal end of the palpus, as a rudimentary segment can be seen at the apex.

The greatest variation occurs in the tribe Culicini, which contains the most blood-thirsty members of the family. Only in certain species of *Psorophora* do the palpi approximate half the length of the proboscis, but even in these cases, they are decidedly shorter than the antennae. Certain species (e.g., *Aedes scapularis*) still retain the full set of segments, but all have been greatly reduced in size, principally the first, second, and fifth segments. The majority of species, however, possessed only three to four segments, including the fused basal joint.

The greatest reduction has occurred in the tribes Uranotaeniini and Sabethini, which have only a single segment (two, counting the fused basal segment).

(c) *The clypeus.*

This structure is peculiar in that it appears to be developed in accordance with the intensity of the blood-feeding habits. The females of most Culicini and Anophelini have a more or less well developed collar of sclerotin surrounding the base of the mouth parts; whereas in all males and in the females of *Megarhinus*, *Uranotaenia*, and the Sabethines and certain Culicines as well, the sclerotization is limited to the upper portion of the clypeus, which appears as a lip-like structure between the antennae and the mouth parts. In *Megarhinus*, it differs further, being much broader than it is long. It is at least as long as it is broad in all other tribes.

(2) TIME OF ACTIVITY.

The most striking modifications in appearance, affecting chiefly the vestiture and coloration, appears to have resulted from the differences in the time of activity. Apparently the more important distinction that should be made in this connec-

tion is the time and manner of mating (i. e., courtship). This, in turn, may possibly be due to some fundamental difference in biology, such as change of larval habitat or feeding methods or both.

The males of many of the Nematocerous Diptera, which are aquatic in the immature stages, orient themselves to some conspicuous object at the time of mating, and are thus enabled to form swarms to which the females are attracted. Swarming usually occurs during twilight hours. Among such species the localizing of the males is probably sufficient to overcome the difficulties of the sexes in finding one another, and consequently there is little need for bright colors, which otherwise would have had to be developed for the purpose of attracting the sexes, unless the insects resorted to still other methods. In this connection, it may be pointed out that the species which swarm usually have sombre colors, or if they possess definite markings, these are not, as a rule, of metallic lustre.

The males of most, or all, of the more primitive mosquitoes form their swarms about dusk, and it is noteworthy that although many have definite color markings, these consist of various shades of black, brown, and white, and are almost invariably of a non-metallic nature.

It may be assumed, therefore, that the progenitors of the present day mosquitoes were of a uniformly dark color, without scales, except possibly on the wing veins, and that they accomplished the act of mating through the process of swarming during twilight hours.

The Brazilian species which more nearly approach this primitive type of vestiture (general absence of scales) belong to the Anopheline subgenus *Stethomyia*. Unfortunately nothing is known of their mating habits, but the females of this group are among the few Anophelines which fly more or less freely and feed during the day. Their chief time of feeding, however, is probably early evening. Also, they are the only Anophelines in America that possess a conspicuous white marking in the integument of the mesonotum (a narrow white longitudinal line). Dr. Davis reports that the variety *brasiliensis* of *Anopheles albitarsis* is well known to have day-flying and day-feeding habits in the state of Minas Geraes. It is interesting to note that in this form the tip of the abdomen is conspicuously white.

The Anophelines as a class are probably the most primitive of the American mosquitoes in body vestiture. In the species possessing an elaborate development of scales, these are usually on the wings, although *Chagasia* has a remarkable development of scales on the mesonotum. The Anophelines are the only group which do not have scales on the first abdominal tergite, and in fact most species have few or no abdominal scales.

The majority of the species of the tribe Culicini (exceptions noted below) have the poorest development of scales on the first tergite, frequently consisting of a rather small patch. In the Uranotaeniini, the first tergite is fairly well clothed with scales, but the scales lack a metallic lustre. The highest development occurs in the Megarhinini, Sabethinini, and *Haemagogus* (Culicini) which have the first tergite and the sides of the thorax densely clothed with scales, more or less of a bright metallic lustre. A number of species of the tribe Culicini, chiefly certain species of *Psorophora* and certain subgenera of *Aedes* and *Culex*, as well as all the Brazilian species of *Uranotaenia*, have scattered patches of metallic scales.

The two extremes of scale vestiture, therefore, are represented by *Stethomyia* (*Anopheles*), with only a small patch of scales on the head and hair-like scales on the wings, and *Sabethes*, with a mail-like covering of metallic scales on the occiput and body, and an enormous development of the scales on the legs. Other peculiarities of scale vestiture, as shown by certain members of the family, are the presence of scales on the clypeus (*Stegomyia*, *Aedomyia*, and certain Sabethines) and on the postnotum (certain Sabethines), normally an absolutely bare structure except for a tuft of setae on the postnotum in the Sabethini and in certain small groups of Culicini.

As stated above, these modifications probably have been brought about chiefly in response to changes in mating habits. This will be shown in the following. We have personally observed the mode of mating of only a few species (*stegomyia*, *Culex quinquefasciatus*, *Mansonia justamansonia*, *Wyeomyia bromeliarum*, *Limatus durhami*, and *Megarhinus trinidadensis*). Howard, Dyar, and Knab (1912), however, cite observations on *Aedes atropalpus*, *Culicella*, and various species of *Anopheles*. These observations have been used in the generalization here made.

(a) *Day fliers.*

The day fliers may be divided in two groups: (A) those which mate during the day and (B) those which mate during twilight hours.

Group A.—The Megarhines, Sabethines, certain subgenera of *Aedes* (*Stegomyia*, *Howardina*, and *Finlaya*), the Aëdine genus *Haemagogus*, and the subgenus *Carrollella* (*Culex*) belong in this group. All are more or less marked with metallic colors, and all breed in natural containers (tree holes, etc.) in or about woodlands, where they are protected from the sun (except the domesticated *stegomyia*, which breeds in artificial containers in and about houses). As a rule they do not fly far from their larval habitats, and, as far as is known, the males do not form

swarms at the time of mating. The males of these groups are occasionally seen on the wing during the day, whereas the males of group B appear to be on the wing only during twilight hours. The majority of the species are rare, and it is therefore probable that the brilliant colors were developed to enable the sexes to detect one another more easily.

The male Megarhines rest on the leaves of plants in patches of sunlight and await the appearance of the females. Nothing is known regarding the mating of the Culicine groups, except in the case of *Stegomyia*. The males of this group frequently rest in the immediate vicinity of people and await the coming of the female in search for food, or rest on exposed perches (projections of furniture, etc.) where they can easily detect passing females. The Sabethine males drift about the woodlands in slow flight, exhibiting their colors, or, as in the case of the males of *Limatus*, fly slowly up and down tree trunks, purposely exhibiting the blue marking on the proboscis. The latter differ from all other mosquitoes in having a proboscis which can be flexed at the middle; the outer half can be bent upwards at right angles to the basal half, and at the base of the outer half there occurs a conspicuous metallic blue spot edged with black.

Quite probably the Uranotaenines belong to group A, since they possess metallic markings and are day fliers, but their larval habitats (marshy pools, etc.) differ from those of the other species included in this group. Nothing is known regarding their mating habits.

Group B.—At least the majority of the species of *Psorophora*, *Aedes*, and *Mansonia* probably belong in Group B. In reality, this group is intermediate between the true day fliers and the essentially twilight and night fliers, since, although the females are frequently on the wing in great numbers during the day, seeking food, their hours of greatest activity are at twilight. Moreover, females of this group may be found abroad at all hours of the night. The group differs as a class from Group A, in being ground-water breeders, much stronger fliers, and of a more blood-thirsty nature. The adults usually occur in more or less open land areas, and probably as a result of this their bodies are more heavily sclerotized than are those of most other mosquitoes. This is indicated by the fact that dried specimens undergo less shrinkage than specimens of the majority of the other species. We have personally observed the swarming of *Mansonia justamansonia* only, but according to the records given by Howard, Dyar, and Knab (1912) relative to the swarming of allied species of *Aedes*, it is probable that the Brazilian species of this genus (aside from those listed under group A) likewise swarm. Nothing is known regarding the mating of the species of *Psorophora*. Certain of these, as well as *Mansonia arribalzagia* and *M. lynchi*, new species described below, have

metallic markings, and in view of this fact, it is possible that they do not form swarms. The genus *Culicella*, which is not found in Brazil, may belong to group B.

(b) *The essentially twilight and night fliers.*

This class includes practically all Anophelines, all species of the genus *Culex*, except *Carrollella* and possibly *Microculex*, and probably the species of *Lutzia* and *Deinocerites* as well.

The typical representatives are either entirely dark in color, or show a color pattern consisting of two or three non-reflecting colors—black, brown, and white. Feeding takes place as a rule only at twilight and during the night; in fact, the great majority of the species are relatively inactive during the day. Consequently, it is to be expected that mating takes place only at twilight, and that the males, in most or all cases, swarm. Such is certainly the case with *Culex quinquefasciatus*; and, according to observations made on several species of *Anopheles* in various parts of the world, this is, in all probability, the case with the Brazilian Anophelines.

Finally, with regard to the modification of vestiture as occasioned by habits, it is of interest to note that the males have not kept pace with the females. In the male the wing scales are usually small and less numerous, while the abdomen is usually less completely scaled and retains the hairs to a greater extent. As a specific example of this, the abdominal tergites of the female *Aedes taeniorhynchus* are completely scaled and the hairs are greatly reduced in number and size; in the male the sides of the tergites are unscaled, but possess instead numerous long hairs.

(3) MODIFICATIONS DUE TO MODES OF CONCEALMENT AND ATTACK.

The only probable example of adaptive coloration to be found in the Brazilian mosquitoes occurs in the genus *Orthopodomyia*. The adults of this genus are mottled brown and white and greatly resemble certain species of *Mansonia*. But while the *Mansoniae* are strong fliers and notoriously blood-thirsty, the *Orthopodomyiae* are not known to suck blood (the clypeus is lip-like; in *Mansonia* it is collar-like); and although the adults are rarely found, they have occasionally been seen resting on tree trunks.

(4) MODIFICATIONS DUE TO METHODS OF ATTACK.

These are not readily apparent in the structure, but express themselves rather in the psychological attitude. The behavior of stegomyia, *Mansonia*, and the Sabethines is characteristic and distinctive. These characters, however, are unsuitable for use in a key and therefore need not be further considered here.

(5) MODIFICATIONS DUE TO METHOD OF MATING.

Probably the chief modification brought about by the method of mating occurs in the claws of the females. Knab (1907) states his belief that in the species in which the claws are simple, the position of copulation is one in which the sexes are end to end and facing in opposite directions (based on observations made on *Anopheles*, *Culex*, and *Culicella*), while in the species in which the female has toothed claws, the position in copulation is face to face, the pair clasping each other (observations made on *Stegomyia* and *Aedes varipalpus*).

However, this rule does not appear to apply to the Sabethini. The mating position assumed by *Wyeomyia bromeliarum* and *Limatus durhami* is similar to that of *Stegomyia*, yet the females of both of these species have simple claws. On the other hand the claws of the males are somewhat more modified in the members of this tribe than is the case in others.

III. KEY TO THE TRIBES AND GENERA OF BRAZILIAN CULICINAE.

(The characters which are, as a rule, most convenient for identification, are printed in **bold face type**.)

Tribe ANOPHELINI.

1. First abdominal tergite without scales; hind coxa slightly shorter than width of mesipimeron; proboscis straight; **palpi of female straight and approximating the length of the proboscis** (certain females of *Megarhinus* have palpi nearly as long as the proboscis, but in these the proboscis is strongly curved downward and the last palpal joint is strongly directed upward); scutellum crescent shaped with the setae uniformly distributed, except in *Chagasia* which has a trilobed scutellum with the setae grouped on the lobes; base of hind coxa distinctly below upper margin of the meso-merocoxa, except in *Stethomyia* where the two are almost on the same level; legs very long and slender; the hind basitarsis longer than the hind tibiae; spiracular setae usually present; sides of thorax with few or no scales; squamal fringe of setae present; color pattern limited to non-metallic shades of black, gray, brown and white (*Anophelini*).....2.
- First abdominal sclerite with at least a patch of scales; hind coxa distinctly longer than width of mesepimeron; **palpi of female decidedly shorter than proboscis**, except in certain species of *Megarhinus* (large and of brilliant metallic coloration); scutellum trilobed with the setae grouped on the lobes, except in the *Megarhinini*, which have the posterior margin straight.....4.
2. Integument of mesonotum with a very slender, distinct white longitudinal line; **antennal hairs of female as long as width of thorax**; spiracular setae absent *Stethomyia*.

Integument of mesonotum without a slender white line (some species of the subgenus *Anopheles* have a broad grayish line); **antennal hairs of female much shorter than width of thorax**; spiracular setae present.....3.

3. Scutellum trilobed; **antennal hairs of female with knobs of scales at apices of the first seven basal flagellar joints**; terminal antennal joints of male circular in cross section; sides of mesonotum with erect scales; hind basitarsis nearly twice the length of hind tibia.....*Chagasia*.
 Scutellum crescent shaped; flagellum of female without knobs of scales, except occasionally on first one or two joints; hind basitarsus but little longer than hind tibiae.....*Anopheles*.

Tribe MEGARHINI.

4. **Very large more or less metallic colored species with the proboscis strongly curved downward**; palpi of female longer than the antennae; clypeus much broader than long; thorax (including the sides) and abdomen densely covered with scales; length of the forked branches of second vein much shorter than the preceding simple section (similar to that in *Uranotaenia*, see plate 7) a spurious vein present on inner side of fifth vein as well as an outer, the former with a V-shaped ending; base of hind coxa in line with upper margin of the meso-merocoxa; spiracular setae present; squamae without fringe of setae.....(Megarhinini) *Megarhinus*.
 Proboscis straight, occasionally slightly distorted (except in certain small species of the Sabethines which have a very long, strongly recurved proboscis); **females with the palpi much shorter than the antennae**; clypeus at least as long as broad; no spurious vein on inner side of lower branch of fifth vein (only the outer one present).....5.

Tribe URANOTAENIINI.

5. **Small to very small species, the thorax brown with metallic blue or white lines or spots, mesonotal setae well developed**; palpi (both sexes) extremely small, each with but a single segment; spiracular setae present; sterno-pleura with a transverse suture (plainly visible in potash-treated specimens); base of hind coxa distinctly below upper margin of meso-merocoxa; wings without villi (except in *U. geometrica*); **branches of second vein much shorter than the preceding simple section**; **anal vein ending at, or slightly before, the fork in the fifth vein** (see plate 7) (certain species of *Haemagogus*, tribe Culicini, have their venational characters closely approaching the ones here given; they may easily be distinguished from *Uranotaenia* by the dense covering of metallic scales on the mesonotum and abdomen and lack of setae on the mesonotal disk); wing with patches of silvery white or metallic blue scales, at least along base of fifth vein; squamae without fringe of setae.....
 (Uranotaeniini) *Uranotaenia*.

Mesonotum of various colors, the disk with or without setae; sternopleura without transverse suture; wings with villi; **branches of second vein at least as long as, usually longer than, the preceding simple section** (except certain species of *Haemagogus*, see above); fifth vein uniformly scaled.....6.

Tribe CULICINI.

6. Palpus of female with two to four differentiated segments; **hind tibia at least as long as fore tibiae; base of hind coxa distinctly below upper margin of meso-merocoxa** (except *Haemagogus*); spiracular setae usually absent; squamae with a fringe of setae (very rarely incomplete); postnotum usually without setae (present in some species of *Haemagogus*, *Deinocerites*, and *Culex*, i. e., the subgenus *Carrollella*); disk of mesonotum usually with setae (Culicini).....7.

Palpus of female with a single well developed joint; **hind tibia distinctly shorter than fore tibia; base of hind coxa in line with upper margin of meso-merocoxa**; spiracular setae present, except in *Limatus*; squamal fringe incomplete (*Joblotia* and certain species of *Goeldia*) or entirely absent; sides of thorax for the greater part densely scaled; disk of mesonotum densely scaled and without setae; postnotum always with a tuft of setae; metallic colors usually present (especially on head and prothoracic lobes).....

Sabethini 16.

7. Scales on anal vein large and outstanding, their outside margins forming a broad line (the width being more or less equal to the length of the scales forming the fringe on the posterior margin of the wing).....8.

Scales on anal vein very small and usually closely applied to the vein, forming but a slender line.....10.

8. Antennal joints scarcely longer than broad; clypeus with scales (dull white in color) wing membrane rather completely overlaid with scales; width of anal cell only about equal to the length of the scales composing the posterior wing fringe.....

Aedeomyia.

Antennal joints distinctly longer than broad; clypeus bare; posterior portion of the wing with large areas of membrane exposed; width of anal cell distinctly greater than length of fringe scales.....9.

9. Without spiracular and mid-mesepimeral setae; **fourth and fifth fore tarsal joints shorter than the third**.....*Orthopodomyia*.

Either post-spiracular or mesepimeral setae present (usually both); **fourth and fifth fore tarsal joints longer than the third**.....

Mansonia.

10. Brilliant metallic dark blue to green with sides of thorax and abdomen densely white scaled; first abdominal tergite entirely scaled; tergites three to four and disk of mesonotum without setae; spiracular and post-spiracular setae absent; hind basitarsus distinctly shorter than hind tibia*Haemagogus*.

- Without brilliant dark blue or green coloration; first abdominal tergite but partially scaled; all abdominal tergites with setae, at least on posterior margins; disk of mesonotum very rarely without setae.....11.
11. Lower side of stem vein setose; spiracular setae present; postspiracular setae absent (*North American*).....*Culicella*.
- Lower side of stem vein bare.....12.
12. Hind basitarsus shorter than hind tibia; eighth abdominal segment of female usually not apparent (being retracted into the seventh), the dorsal surface unscaled, tip of abdomen rather sharply pointed, the effect being chiefly from the prominent, laterally flattened, cerci (exceptions: the subgenus *Finlaya* (*Aedes*) has the eighth segment exposed and scaled above and the cerci but little protruding; *Howardina* (*Aedes*) has both the eighth segment and the cerci short); pulvilli absent; postspiracular setae present.....13.
- Hind basitarsus slightly longer than hind tibia, eighth abdominal segment of female visible and scaled dorsally; tip of abdomen blunt, the cerci short, and inconspicuous; pulvilli present; post-spiracular and spiracular setae absent.....14.
13. Spiracular setae present.....*Psorophora*.
- Spiracular setae absent.....*Aedes*.
14. Very large species with dark and light wing areas.....*Lutzia*.
- Moderate to small species; wing scales all dark.....15.
15. Antenna much longer than proboscis (*Caribbean coast region*).....*Deinocerites*.
- Antenna not longer than proboscis.....*Culex*.

Tribe SABETHINI.

16. Prothoracic lobes sublateral; palpi of female more than twice the length of clypeus; male palpi usually long, approximating length of proboscis.....17.
- Prothoracic lobes collar-like; palpi of female distinctly shorter than in preceding group; male palpi always short.....18.
17. Clypeus setose.....*Joblotia*.
- Clypeus bare.....*Goeldia*.
18. Mesonotum with brilliant golden and purplish areas; length of palpus not exceeding that of clypeus; spiracular setae absent, the area being densely scaled.....*Limatus*.
- Mesonotum without this coloration; length of palpus somewhat longer than that of clypeus; spiracular setae present.....19.
19. At least the middle legs with paddle-like development of scales; fore femora shorter than the middle ones; prealar and propleural setae absent.....*Sabethes*.
- Legs without paddle-like development of scales, i. e., uniformly slender; fore femora as long as middle ones; propleural setae present.....20.
20. Prothoracic lobes closely approximated dorsally; prealar setae absent; general coloration a deep metallic blue.....*Sabethoides*.

- Prothoracic lobes moderately approximated; prealar setae present;
rarely with a deep metallic general coloration 21.
21. Lower sternopleural setae all located below level of upper margin of
 meso-merocoxa 22.
 Lower sternopleurals extending above this level 23.
22. Wing scales broad *Miamiya*.
 Wing scales narrow *Hycomyia*.
23. Postnotum covered with white scales; wing scales narrow *Menolepsis*.
 Postnotum with few or no scales; wing scales broad *Dendromyia*.

IV. CLASSIFICATION OF THE BRAZILIAN REPRESENTATIVES OF PSOROPHORA, AÊDES, AND MANSONIA.

Genus *Psorophora* Robineau-Desvoidy, 1827.

A genus evidently of tropical American origin and entirely of American distribution, most probably derived from the Aëdine subgenus *Ochlerotatus*. The largest of the blood-sucking mosquitoes belong here. The larvae occur in transient rainpools and develop with great rapidity.

Three subgenera are recognized on the basis of the external characters of the adults and genitalic characters of the males.

The following subgeneric classification is principally based on the characters of the females.

KEY TO THE SUBGENERA OF PSOROPHORA (*Brazilian Species*).

1. Very large species; mesonotum with smooth longitudinal nude areas.
 Female: Palpus equal in length to five or more of the basal flagellar
 segments; tarsal claws toothed Subgenus *Psorophora*.
 Moderate size species; mesonotum with uniform distribution of scales;
 palpus of female decidedly shorter. 2.
2. Tarsi dark except the fifth hind tarsal (and sometimes the fourth),
 which is completely white; claws of the female toothed
 Subgenus *Janthinosoma*.
 Tarsal segments white ringed; claws of the female simple
 Subgenus *Grahamia*.

Genus *Aedes* Meigen.

The genus *Aedes* is second only to *Culex*, in the number of its species found in America. Dyar (1928) records eight subgenera and 110 species of *Aedes*. The species of this genus found in North America (75) outnumber all other species of mosquitoes found there. However, the American tropics possess a very limited Aëdine fauna.

Six of the subgenera, but only thirteen of the species, are at present known to occur in Brazil.

A comparison of the subgenera and species occurring in Brazil and in America as a whole follows:

Subgenus	America	Brazil
<i>Aedes</i>	1	0
<i>Aëdimorphus</i>	1	0
<i>Stegomyia</i>	1	1
<i>Conopostegus</i>	1	1
<i>Howardina</i>	13	2
<i>Finlaya</i>	8	2
<i>Taeniorhynchus</i>	10	2
<i>Ochlerotatus</i>	75	5

The first three subgenera are typically an Old World group, while representatives of probably all the others, except *Conopostegus*, likewise occur there. The Old World possesses, in addition, about eight subgenera not represented in America.

KEY TO THE SUBGENERA OF *AÊDES* (Brazilian).

1. Clypeus, prothoracic lobes, mesopleura, mesepimeron (upper portion only) and hind coxa with white scales of metallic lustre; occiput without erect scales (save those composing the ruff); tarsi with white rings. Female: eighth abdominal tergite scaleless and retracted; tarsal claws toothed.....*Stegomyia*.
Clypeus without scales.....2.
2. Mesepimeron with scales of distinct metallic lustre extending nearly its entire length; other markings distinctly metallic. (Tree-hole breeding species).....3.
Mesepimeron with the scales confined to the upper half; markings not distinctly metallic; hind coxa with few or no scales. Female: Eighth abdominal tergite unscaled and retracted, the cerci long (exception: *fluviatilis*, as in *Finlaya*); claws toothed. (Ground-water breeders).....5.
3. Hind tarsi with a single pale ring at base of first segment; mesonotum with golden markings. Female: Eighth abdominal segment retracted; cerci short; claws simple.....*Howardina*.
Hind tarsi without rings or with a broad ring involving the apex of the first and the base of the second segments; mesonotum with silvery markings. Female: Eighth abdominal segment protruding and scaled above; claws toothed.....4.
4. Base of costa black scaled; hind tarsi without ring; a slender line extending full length of mesonotum; occiput without erect scales aside of the ruff.....*Conopostegus*.
Base of costa white scaled; hind tarsi with rings; mesonotum with sides broadly silvered (at times the silvered areas confluent); occiput with erect scales.....*Finlaya*.
5. Hind tarsi with rings; sides of first abdominal tergite with white scales.....*Taeniorhynchus*.
Hind tarsi without rings; sides of first tergite without scales.....*Ochlerotatus*.

KEY TO SPECIES OF PSOROPHORA AND AÈDES

(Because there are but few species in Brazil belonging to these genera and because of the difficulty of separating them generically, they have been grouped together.)

1. Proboscis with a more or less distinct light ring or area at about the middle; tarsi with rings on all the segments.....2.
 Proboscis uniformly dark.....4.
2. Abdominal white cross-bands on the basal margins of the tergites; last hind tarsal completely white; claws toothed.....
 Aedes (Taen.) taeniorhynchus.
 Abdominal cross-bands (more or less interrupted in the middle) on the posterior margins of the tergites; last hind tarsal black with a white basal ring; claws simple.....3.
 Wings with whitish and dark scales.....*Ps. (Grab.) confinnis*.
 Wing scales all dark.....*Ps. (Grab.) cingulata*.
4. Very large species; length of palpus equal to at least the five basal flagellar joints; mesonotum with scaleless, shining longitudinal areas.....5.
 Moderate to small species; palpus distinctly shorter; mesonotum uniformly scaled, sometimes sparsely.....7.
5. Sides of thorax (pleurae) practically scaleless; mesonotum with a pair of uniformly slender white lines.....*Ps. (Ps.) genumaculata*.
 Sides of thorax largely covered with scales.....6.
6. Median mesonotal stripe golden brown; proepimeron without scales (or extremely few).....*Ps. (Ps.) ciliata*.
 Median mesonotal stripe black; proepimeron with large scattered white scales.....*Ps. (Ps.) cilipes*.
7. Fifth and usually the fourth hind tarsals completely white, remainder of the tarsi black.....8.
 White markings of the tarsi, if present, not confined to the fourth and fifth hind tarsals.....10.
8. Mesonotum with small, uniformly scattered scales.....*Ps. (Jan.) ferox*.
 Mesonotum with a broad, dark, central stripe; the sides light colored.....9.
9. Fourth hind tarsal white; sides of mesonotum with yellowish scales.....
 Ps. (Jan.) lutzi.
 Fourth hind tarsal partly black; sides of mesonotum whitish.....
 Ps. (Jan.) varipes.
10. Hind tarsi without rings.....11.
 Hind tarsi with rings, at least at base of first tarsal segments.....17.
11. Prothoracic lobes silvered; a slender silvery line extending from between the eyes backwards to tip of scutellum; mid-femur with a white exterior spot beyond the middle.....*Aedes (Conop.) leococelaenus*.
 Prothoracic lobes with lusterless scales, mid-femur without an isolated white spot.....12.
12. Integument of mesonotum bright reddish yellow with a posterior pair of black spots and but very sparsely clothed with small yellow scales.....
 Aedes (Och.) fulvus.

- Integument of mesonotum dark brown and rather thoroughly covered with scales 13.
13. Mesonotum uniformly dark scaled (male with a slender white stripe).
Aedes (Och.) nubilus.
- Mesonotum with white stripe..... 14.
14. Mesonotum with a slender white line; antenna slightly longer than proboscis..... 14.
- Mesonotum with a broad stripe or patch of slight scales; antenna distinctly shorter than proboscis..... 16.
16. Mesonotal stripe creamy white in color; species of moderate size
Aedes (Och.) serratus.
- Mesonotal stripe bluish white; small species..... *Aedes (Och.) hastatus*.
16. Mesonotum with a broad patch of white on anterior three-fifths (i. e., ending before wing bases)..... *Aedes (Och.) scapularis*.
- Mesonotum with a broad stripe extending as far back as the wing bases..... *Aedes (Och.) orinifer*.
17. All hind tarsals with rings..... 18.
- Last three tarsals without rings..... 19.
18. Clypeus with white scales; a lyre-shaped marking on mesonotum.
A. (Steg.) aegypti.
- Clypeus nude; anterior portion of mesonotum largely pale scaled
Aedes (Taen.) fluvialis.
19. Mesonotum black and silvery..... 20.
- Mesonotum black and golden..... 21.
20. Sides of mesonotum silvery; only the base of costa white scaled; palpi of male as long as proboscis..... *Aë. (Fin.) terreus*.
- Female unknown, but male with anterior two-thirds of mesonotum entirely silvery; stem vein as well as costa white scaled; palpi distinctly shorter than proboscis..... *Aedes (Fin.) argyrothorax*.
21. Mesonotum chiefly golden scaled..... *Aedes (How.) fulvithorax*.
- Mesonotum chiefly dark scaled with slender golden lines.....
Aedes (How.) septemstriatus.

KEY TO THE LARVAE OF PSOROPHORA.

1. Anterior corners of head squared; mouth brushes widely separated, prehensile; air-tube without a median enlargement. (Subgenus *Psorophora*)..... 2.
- Anterior corners of head rounded; mouth brushes normal; air-tube enlarged more or less at the middle..... 4.
2. Air-tube pecten extending far beyond the middle, the tuft (consisting of a pair of long hairs) subapical..... *cilipes*.
- Air-tube pecten only extending as far as the middle; the tuft located within the outer third..... 3.
3. Air-tube tuft multiple, shorter than the width of the tube..... *genumaculata*.
- Air-tube tuft consisting of a single long hair..... *ciliata*.
4. Antenna distinctly longer than the width of the head (Subgenus *Xanthosoma*)..... *ferox*, *lutzii*, and *varipes*.

- Antenna as long as or shorter than the width of the head (Subgenus *Grahamia*).....5.
 5. Head as long as broad.....*cingulata*.
 Head broader than long*confinnis*.

KEY TO THE LARVAE OF AÈDES.

1. Antennal hair "tuft" (arising more or less at the middle of the shaft) consisting of a single hair (minute in stegomyia); anal segment broadly membranous on ventral surface (container, artificial and natural, breeding species).....2.
 Antennal tuft consisting of two or more hairs (ground-water breeders).....5.
2. Comb scales on eighth segment arranged in a single straight row of 8-12 scales (very rarely more, occasionally 18 in stegomyia).....3.
 Comb scales in a very irregular single row or several rows deep.....4.
3. Posterior margin of the sclerotized plate on the anal segment not spinose; the individual scales of the eighth segment comb with the basal (semi-transparent) portion more or less sole-shaped and with the apical (opaque) portion showing a strong apical and several lateral spines; the short hair tufts of thorax and body inconspicuous and with one to three hairs.....*aegypti*.
 Posterior margin of the sclerotized anal plate distinctly spinose; comb scales with the semi-transparent portion oval and with a single spine; the short hair tufts of thorax and body conspicuous and composed of four to five hairs.....*leucocelaenus*.
4. Comb scales in an irregular or double row, 12-20 in number; apical portion of the individual scales much longer than the basal, spatulate in shape, fringed but without spines; body with conspicuous stellate hairs.....*fulvithorax*.
 Comb scales very numerous (40-50) arranged in a triangular patch, shape as in *fulvithorax*; body hairs similar but not as conspicuous (i. e., rather long and slender, or less spinose in structure).....*terrens*.
5. Anal segment membranous along ventral surface; basal portion of comb scales somewhat shorter than the coarsely fringed apical part.....*fluvialis*.
 Anal segment completely banded with sclerotin.....6.
6. Pecten of air-tube with detached teeth outwardly.....*fulvus*.
 Pecten consisting of evenly spaced teeth.....7.
7. Air-tube nearly four times as long as wide; anal gills extraordinarily long.....*hastatus*.
 Air-tube less than three times as long as wide; anal gills moderate or very short.....8.
8. Comb containing 10-12 teeth in a straight line.....*serratus*.
 Comb with many (20 or more) in a triangular patch.....9.
9. Anal gills much longer than broad, body densely pilose.....*scapularis*.
 Anal gills very short, nearly as long as broad; body moderately pilose.....*taeniorhynchus*.

Psorophora (Psorophora) ciliata Fabricius, 1794.

A very large, brown to very dark brown, species with moderately shaggy legs and fairly distinct tarsal rings; distinguished from its allies by the median longitudinal stripe of brown scales.

This species has an extraordinarily wide geographical range, extending from southeastern Canada to about the middle of Argentina. The form found in the middle coast states of Brazil differs noticeably from specimens taken in Argentina and North America in being of a much darker color. It does not differ structurally. The species is apparently rare in the middle coast states. Our material consists of reared specimens, a small lot collected near the city of Bahia and another from the city of Pernambuco, both collected during the early part of the rainy season.

The species also occurs in the southeastern Brazilian states (Cesar Pinto).

Psorophora (Psorophora) cilipes (Fabricius), 1805.

A very large black species with a diffuse sprinkling of white scales on occiput and thorax; abdomen deep metallic violet blue, legs shaggy in appearance, the tarsi without white rings.

Evidently of strictly tropical distribution, Mexico to southern Brazil. Has been found in all three of the Brazilian coastal regions. Our material consists of specimens reared from larvae found near the city of Bahia during the early part of the rainy season.

Psorophora (Psorophora) genumaculata, Oswaldo Cruz, 1907

A very large shining black species with a widely separated pair of slender white lines on the mesonotum; legs entirely black, moderately shaggy; wings rather strongly infuscated.

The species was placed by Dyar (1928) as a synonym of *Psorophora lineata* (Humboldt). Recently Cesar Pinto (1930) has shown it to be specifically distinct. To date, it has been found only in Brazil and Misiones (Argentina) which adjoins Brazil. Adults have been collected on a few occasions but most of our material consists of reared specimens, the larvae of which were found associated with *ciliata* and *cilipes* larvae.

Psorophora (Janthinosoma) ferox (Humboldt), 1820.

A more or less woodland species; although only moderately common, it is probably the commonest species of the genus throughout its entire range, which is coextensive with that of *ciliata* (Canada to middle Argentina).

A fairly large species of a general dark reddish-brown color; occiput with bright yellow scales; the tarsi are black with the

exception of the fourth and fifth hind tarsals which are conspicuously white.

The species has been found in all three of the coastal regions of Brazil. Its principal season of abundance coincides with that of the early rainy season, but adults are found in small numbers throughout practically the rest of the year. They were, however, found in considerable abundance during mid-winter in a locality (Ilhéos) some distance south of Bahia.

The larvae live in temporary rainpools having a grassy bottom, usually adjoining woodlands.

Psorophora (Janthinosoma) lutzii Theobald, 1901.

A rather rare, wide-ranging, tropical, principally woodland species, occurring from Mexico to Argentina. It is easily distinguished (except from *varipes*) by its rather dusky wings, by the broad dark stripe on the mesonotum, bordered by equally broad cream-colored areas, and by the dark hind tarsi tipped with white.

The larvae occur in temporary woodland pools, and after the first heavy rains of the rainy season the adults have a brief period of comparative abundance in their more favorable localities. The species appears to be exceedingly rare about the city of Bahia but has been seen on the wing in numbers near Estancia (Sergipe). It occurs in the three coastal regions of Brazil.

Psorophora (Janthinosoma) varipes Coquillett.

In Brazil, this species appears to be even less common than *lutzii*. It occurs in the southeastern states, but otherwise has practically the same distribution as *lutzii*. The two species are very similar in appearance, being distinguishable only by rather minor differences in color. Their habits are likewise similar. *P. varipes* has been captured in the middle coast and southeastern states of Brazil.

Psorophora (Grabhamia) cingulata (Fabricius), 1805.

Likewise a tropical woodland species (Central America to southern Brazil). Its mottled coloration, striped proboscis, and banded legs give it a superficial resemblance to species of the genus *Mansonia*, from which it may be easily distinguished by its narrow wing scales. The rather silvery cross-bands on the apical margins of the abdominal tergites constitute one of its most distinctive features.

P. cingulata appears to have a longer breeding season, at least in the vicinity of Bahia, than the other species of the genus. Despite its general abundance, larvae have been found on but

few occasions, and then usually in peculiar places, such as a tin can, hoof prints in mud, etc.

The species occurs in the three coastal regions of Brazil.

Psorophora (*Grabhamia*) *confinnis*, Lynch Arribalzaga, 1891.

This species is very similar to *P. cingulata* in appearance and habits, and practically coextensive with it. It differs from *P. Cingulata* in having the abdominal pale markings entirely dull, and the whitish scales intermixed with the black on the wings.

Has been recorded from Pará and the southeastern states, but apparently does not occur in the middle coastal states.

Aedes (*Stegomyia*) *aegypti* (Linnaeus), 1762.

This species represents the only foreign element among the tropical species belonging to the subtribe Aëdini. It differs from all Brazilian species of *Aedes* in many respects, in structure as well as in habits. (Dyar, 1918, has shown, on the basis of the genitalic structure of the male, that it is clearly of Old World origin.) The silvery markings of the head (scales on the clypeus) and thorax (lyre-shaped design on the mesonotum and the scutellum entirely with broad flat scales) easily set it apart from all other American Aëdines. Also, it is the only species not directly dependent upon rainfall, and therefore its breeding can continue practically undisturbed by natural influences, except in the case of cool temperatures and perhaps excessive dryness of atmosphere.

Probably exists along all the main highways of travel throughout Brazil, in the lower altitudes.

Aedes (*Howardina*) *fulvithorax* (Lutz), 1904.

The principal habitat of the rather rare species of *Howardina*, is the countries and islands of the Caribbean. *Aë. fulvithorax* is the chief representative in Brazil. Its distribution is from the southern part of the country northward to Trinidad.

The golden mesonotum, dark abdomen with bright silvery spots on the sides of all the segments and on the dorsum of the fifth to seventh segments, and the single ring on the hind tarsi (base of the first segment) easily distinguish it.

The species lives only in well wooded areas. The larvae are found in rot holes in trees and in the open ends of broken bamboos. The females attack man rather readily; they have also been captured on animal bait (horses, etc.).

Probably occurs along the entire coast of Brazil wherever conditions are favorable, although as yet unrecorded from northern Brazil.

Aedes (*Howardina*) *septemstriatus* Dyar and Knab, 1907.

Evidently a rare species and to date has been recorded only from Nicaragua and Panama.

Agrees with *fulvithorax* in the possession of but a single hind tarsal light ring, but is somewhat larger and more robust. The mesonotum is largely dark-scaled with a diffuse pattern of golden scales forming a very slender median line extending onto the scutellum, and three pairs of additional lines which are very indefinite.

Our collection contains a single female captured on animal bait (horse) at Pará, April, 1930 (N. C. Davis). Larvae have been found in Panama in tree holes.

Aedes (*Conopostegus*) *leucocelaenus* Dyar and Shannon, 1925.

The subgenus *Conopostegus*, containing but a single species, is clearly intermediate between the subgenus *Finlaya* (*Aedes*) and the genus *Haemagogus*. There has been considerable difference of opinion as to whether it should be located in *Haemagogus* or in *Aedes*. Costa Lima (1930) has recently replaced the species in *Haemagogus*. The external characters of both sexes definitely place it in *Aedes*, although the genitalic structures of the male are rather definitely of the *Haemagogus* type. Inasmuch as it is preferable to base generic distinctions on characters possessed by both sexes rather than on the secondary sexual characters of the male, it is here proposed to keep the subgenus in *Aedes*.

The species occurs from Panama to Argentina. In Brazil, it has, up to the present, been found only in the southeastern states. It is restricted to wooded areas, and the larvae live in tree holes. Costa Lima (ibid) gives photographs of the larval skins, from which the description of the species (as given in the larval key) is derived. The adults are known to attack man.

Aedes (*Finlaya*) *terrens* (Walker), 1856.

Although one North American species of the subgenus *Finlaya* occurs as far north as New Hampshire and Montana, the species are chiefly of tropical distribution. *Ae. terreus* is the chief representative (at least in Brazil) and occurs from Mexico to southern Brazil.

The species is characterized by dark median stripe on the mesonotum, broadly silvered sides, and hind tarsi with two light rings, the first narrow and located at the base of the first segment, the second broad and involving the apex of the first and the base of the second segments.

We have reared two to three hundred adults and all but a very few males have the thoracic pattern as described above. The exceptions have the silvered areas of the thorax confluent,

thus agreeing with the description of *terrens* as given by Dyar (1928). The terminalia of the two forms, however, show no obvious differences, and Edwards, to whom specimens were sent, states that they constitute but a single species. He further suggests that *Aë. podographicus* Dyar and Knab (including *metoecopus* Dyar, already placed by Dyar as a synonym of *podographicus*) is but a variety of *terrens*. This would extend the distribution of *terrens* to Ecuador (type locality of *metoecopus*).

Although the larvae are found about Bahia in greater abundance than are the larvae of *Aë. fulvithorax*, the adults have not as yet been found in nature, although females of *fulvithorax* have been captured on a number of occasions while in the act of attacking man. This would indicate a difference of food habits. However, females of *terrens* kept in the laboratory feed on blood with about the same facility as *fulvithorax*.

Aë. terreus is also found in the southeastern states of Brazil, but it has not been recorded from Pará. The larvae are found in tree holes and bamboo joints.

Aëdes (Finlaya) argyritorax Bonne and Bonne Wepster, 1920.

Up to the present time this species has been recorded only from Surinam ("We have two males, one captured near a tree hole at Geiersvlijt, the other in our house at Paramaribo." Bonne and Bonne Wepster, 1925).

We have five males, reared from larvae collected in tree holes. The larvae were not isolated.

Aëdes (Taeniorhynchus) taeniorhynchus Wiedemann, 1921

The subgenus *Taeniorhynchus* is widely distributed in North America, New Hampshire, and British Columbia southwards. In South America it extends as far south as Perú and Brazil.

Aë taeniorhynchus is the best known and most troublesome species of the genus *Aëdes* (excepting *stegomyia*) and extends along the Atlantic coast as far north as New York, and southward as far as southeastern Brazil.

The tinged proboscis and striped tarsi give it a close resemblance to certain species of *Mansonia*. It may be distinguished from the latter by the narrow wing scales, and from the similarly marked species of *Psorophora* by the basal position of the abdominal cross-bands on the segments.

Its principal season of abundance in the middle coast states of Brazil is during the early rainy season. During the dry season of summer a brood follows upon every shower sufficient to fill the rock pools.

***Aedes (Taeniorhynchus) fluviatilis* (Lutz), 1904.**

A comparatively little known species, recorded, up to the present, from Surinam, French Guiana, and Brazil. The larvae are found in the rock pools of stream beds, and breeding therefore is largely governed by rainfall. It attacks livestock and man, and when dwellings are located near the breeding sources it probably is troublesome.

***Aedes (Ochlerotatus) scapularis* (Rondani), 1848.**

The great majority of the American species of *Ochlerotatus* are of strictly north-temperate distribution. *Aë. scapularis*, the commonest tropical species, occurs from the West Indies to Argentina. The large patch of white scales on the anterior two-thirds of the mesonotum is sufficient to distinguish it from its Brazilian allies.

The larvae are found in grassy rain pools, and the species is the only one of the subgenus which breeds freely in suburban districts.

***Aedes (Ochlerotatus) serratus* (Theobald), 1901.**

Strictly tropical, Mexico to Bolivia. A fairly large species, easily distinguished from other Brazilian species of the group by the slender longitudinal line on the thorax.

The larvae are found in grassy rainpools near well wooded areas. The species occurs all along the Brazilian coast in regions suitable for its development.

***Aedes (Ochlerotatus) hastatus* Dyar.**

Recorded to date only from Costa Rica and Panama. The adult is much smaller than *serratus* but otherwise greatly resembles this species. The larvae were found associated with those of *serratus* (Bahia, Brazil).

***Aedes (Ochlerotatus) crinifer* (Theobald), 1903.**

*All records for this species are based on specimens from Pará, southeastern Brazil, and northwestern Argentina. The adults have a fairly broad longitudinal stripe on the thorax, extending as far back as the wing bases. The larvae have been found in grassy rain-pools.

***Aedes (Ochlerotatus) nubilus* (Theobald), 1903.**

Extends from the West Indies to Argentina. The male has a slender thoracic stripe but the female differs from the other Brazilian species of the group in having the mesonotum entirely

dark scaled. The species appears to be strictly a forest inhabitant. Adults have been collected in Pará and in Bahia (Brazil).

The American subgenera and species of *Mansonia*, Blanchard.

The American fauna consists of three subgenera, *Coquillettidia* (North American), *Rhynchotaenia*, and *Mansonia* (tropical; subtropical in Argentina).

Subgenus COQUILLETIDIA.

Proboscis with a broad median pale area; proepimeron uniformly clothed with scales and bearing about 12 setae; post-spiracular setae absent; mesepimeron with anterior four setae and a patch of scales; femora without a distinct subapical white ring but hind femur with a preapical black ring; basitarsus with a median white ring, the other rings located basally on the segments; mesonotal scales appressed; first abdominal tergite with a small, inconspicuous patch of dark scales; wing scales moderately broad, black and white intermixed; halteres pale.

Subgenus RHYNCHOTAENIA.

Proboscis dark, with a well defined median white ring and a smaller ring (distinct in all but *albicosta*) just before the tip; proepimeron with or without scales (when present consisting of a small patch) and with 2 to 6 setae; post-spiracular setae reduced in number and size (at least one or two always present); mesepimeron with one or two anterior setae and with or without a patch of white scales; femora with a subapical pale spot, or (usually) ring; tarsal white rings involving both ends of the segments; first abdominal segment with a very small median patch of dark scales; mesonotal scales appressed; halteres pale.

Subgenus MANSONIA.

Proboscis clothed with intermingled dark and pale scales, with or without a median white ring, and without the preapical white ring; proepimeron uniformly clothed with scattered scales and bearing 6 to 12 setae; post-spiracular setae well developed; mesepimeron with 3 to 5 anterior setae and a few scales intermixed with the upper setae; first abdominal tergite with a conspicuous patch of pale scales; mesonotal scales above wing bases semi-erect; femora with intermingled dark and pale scales and without a subapical white ring; tarsal white rings basal on the segments; wings scales broad, dark and pale intermixed; knobs of halteres dark.

KEY TO SPECIES.

1. Basitarsus with a median white ring (North American)
Man. (Coq.) perturbans Wlk.
- Basitarsus without a median white ring.....2.
2. Tarsal white rings involving both ends of the segments; femora with a subapical pale spot, or (usually) ring.....(*Rhynchotaenia*) 3.
- Tarsal white rings located basally on the segments; femora with intermingled dark and pale scales, without a distinctive pale spot.....
(*Mansonia*) 10.

3. Mesonotum with only dark brown scales through the middle; white markings on thorax, legs, etc., with a distinct metallic silvery lustre.....4.
 Mesonotum with a central pattern composed of golden or brassy scales; white markings without a silvery tinge.....5.
4. Prothoracic lobes and sides of mesonotum with distinct silvery white spots.....*lynchi*, sp. nov.
 Prothoracic lobes and sides of mesonotum with very inconspicuous patches of small brassy scales.....*arribatzagae* Th.
5. Costa entirely dark scaled; hind tibia and usually the others without a series of light spots on outer surface.....6.
 Costa white scaled at base (always ? see note on *fasciolatus*); all tibiae with a series of yellowish spots on outer surface; mesepimeron with a patch of white scales.....8.
6. Wing scales entirely dark; fore and mid tibiae with a large white spot at outer third, hind tibiae with a white ring (Panama).....*nigricans* Coq.
 Wings with white markings, at least near the base.....7.
7. First vein white scaled basally (i. e., a white line present at the wing base just behind the costa which covers the stem vein and continues onto the basal portion of the first vein); fore and mid tibiae with a slender pale line along outer surface, hind tibia with a large white spot at outer third; the upper sternopleural patch of white scales extending onto the mesepimeron.....*albicosta* Chagas.
 First vein with a small white spot just beyond tip of stem vein; tibiae dark, save for the white spot at apex; mesepimeron without scales.....*chrysonotum*.¹
8. Tibiae with a large spot at outer third; wing with scattered white scales anteriorly (Argentina).....*araozi* S. & Del P.
 Tibiae without this spot.....9.
9. Wing with anterior portion inconspicuously mottled with patches of pale scales; fifth and sixth veins completely dark scaled.....*fasciolata* L. A.
 Wing with intermingled, rather broad black and white scales; present also on fifth and sixth veins.....*justamansonii* Ch.
10. Proboscis with a fairly distinct short white ring beyond the middle; mesonotum without a definite pattern.....11.
 Proboscis without this ring.....12.
11. Palpi about one-third the length of proboscis; wing scales decidedly broad.....*titillans* Wlk.
 Palpi about one-fourth the length of proboscis; wing scales moderately broad.....*indubitans* D. & S.
12. Mesonotum covered with dull golden scales anteriorly, mainly dark on posterior third.....*amazonensis* Th.
 Mesonotum as shown but with the anterior golden marking broadly divided by a dark stripe.....*humeralis* D. & K.
 A large brownish species; the wings with broad scales only.....*pseudotitillans* Th.

¹Costa Lima (1930) calls attention to the fact that *M. chrysonotum*, although placed as a synonym of *Man. amazonensis* by Dyar, is a distinct species.

Mansonia lynchi sp. nov.

Proboscis with a conspicuous white median ring, a much smaller one basad of the labellae; palpi one-fourth length of proboscis, tips silvery; upper lateral margins of occiput silvery scaled, those patches converging and passing forward between the eyes; remainder of occiput with sparse erect dark scales and setae. Prothoracic lobe with silvery patch above; mesonotum dark brown, three very small and inconspicuous patches of white scales on anterior margin, a small but very conspicuous patch of silvery scales above the mesothoracic spiracle, a similar patch close to base of wings and also on median scutellar lobe; two similar and widely separated patches on sternopleura and a large one on mesopleura; mesopleura with two anterior median setae; all femora dark, with silvery apices and a rather small patch on upper side beyond middle; tibiae dark, the front pair tipped with silver; fore tarsi with two incomplete rings; mid tarsi with spot at base of first and at base of second segments; hind tarsi with a fairly large spot at base of first segment, a ring at base of the second, third, and fourth segments, the fifth entirely pale (shading from silver to cream yellow); abdomen dark above, silvery spots on side of tergites, also on sternites; halteres partly silvery; wing with a single silvery spot, located just beyond tip of "stem" vein.

Mansonia arribalzagae Th.

Differs from *M. lynchi* as follows:

General color more reddish brown; occiput with small, rather widely scattered (more grouped at apex) brassy scales; the silvery patches on mesonotum, prothoracic lobes, and scutellum replaced by much less conspicuous patches of brassy scales, except that the patch near the wing base is black; a dark yellow ring on fore femur beyond the middle; legs otherwise very similar; wing without the silvery spot.

Figures of the terminalia of both species are shown on plate 9. The principal differences are shown by structure of the phallosome and of the clasper.

Types (male holotype, female allotype) to be deposited in the U. S. National Museum. Paratypes: One male, one female. Type locality: Pará, Brazil (April, 1930, hand captures in woods, N. C. Davis collector).

Numerous specimens of *M. arribalzagia* were collected at the same time.

I am indebted to Mr. F. W. Edwards for comparing a description of the new species with the type of *M. arribalzaga* (in the British Museum) and confirming the fact that it is a new species.

V. NOTE ON THE "SPECIES" OF CHAGASIA (*Anophelini*).

Three species have been described under the genus *Chagasia*: *C. fajardoi* (Lutz), 1904, *C. bonneae* Root, 1923, and *C. bathanus* Dyar, 1928.

C. bonneae was distinguished from *fajardoi* chiefly on the basis

of apparently highly satisfactory characters present in the pupa and male genitalia. *C. bathanus* was distinguished from *bonneae* chiefly by certain color differences in the adult, and by pupal characters. The known distribution of the three forms would, ordinarily, likewise indicate them to be distinct, southeastern Brazil, Surinam, and Panama respectively.

During a trip into the interior of the state of Bahia (Bomfim), a fairly mountainous region with swift flowing streams, Dr. N. C. Davis and the writer found a number of larvae, pupae, and adults (the latter attacking horses at dusk).

Both types of pupae as described, for *fajardoi* (without a flap-like projection on the breathing trumpet) and for *bonneae* (with a flap-like projection), were found. However, each type of pupa produced both types of male, i. e., males with but two spines on the sidepiece (*fajardoi*) and males with about ten spines (as described for *bonneae*).

Admittedly the situation is most unusual, i. e., to have two apparently distinct types of pupae and two equally distinct types of adults in a given species from the same locality. However, we are forced to the conclusion that *C. fajardoi* and *C. bonneae* are but a single species. This being the case, it is highly probable that *C. bathanus*, which differs but slightly from *bonneae*, is likewise a synonym of *fajardoi*.

VI. THE SUBGENUS STETHOMYIA (*Anophelini*).

The group which is here termed a subgenus of the *Anophelini*, presents a number of remarkable features when compared with the remainder of the American fauna of the tribe, indicating that it constitutes a very distinct stock. To emphasize this in the adult stage, a special dicotomy has been included in the key to the tribes and genera given above. Even more striking features are present in the larvae and male genitalia (Shannon and Davis, 1930). If the American fauna only were considered, it should be accorded generic rank. Several Old World species, however, possess the peculiar larval characteristics of *Stethomyia*, as well as the more typical *Anopheles* characters. Should they be found to be definitely allied to *Stethomyia*, the group will, in all probability, have to retain its subgeneric rank.

THE SPECIES OF STETHOMYIA (*Anopheles*).

Until recently it has been thought that *Stethomyia* contained but a single American species. Theobald figured the terminalia of the type species, but apparently, owing chiefly to lack of material, no further study was made of these organs until Bonne and Bonne-Wepster described them in 1926. They named the material before them *S. nimba* Theobald, but it now appears that their specimens belong to a different species.

Shannon and Davis (1930) described also under *S. nimba* Th., the larvae and male of a species found in Bahia, Brazil. The characteristics of the terminalia of the Bahian specimens are similar to those shown in the figure given by Bonne and Bonne-Wepster.

Edwards (1930), basing his study on material from Venezuela and Panama, states: "The Venezuelan specimen agrees with Theobald's rather rough figure of his type from Brazil; the Panama specimen agrees rather closely with the figure given by Bonne and Bonne-Wepster. These two specimens show such marked differences that they almost certainly represent distinct varieties, if not species." To the Panama specimen he gives the name *A. nimbus*, var. *kompfi*.

In view of the abundance of our material from Bahia, which as stated above agrees with the figure given by Bonne and Bonne-Wepster, we can confirm with certainty that the material studied by Edwards represents two distinct species.

This year, Davis collected several females of *Stethomyia*, in Pará, the type locality of *S. nimba*. We were able to distinguish these specimens from the Bahian form on the basis of external characters and considered them to be specifically distinct. However, we have recently obtained in the vicinity of Bahia, several females and a single male (all hand captures), which are quite indistinguishable from the specimens from Pará. The terminalia of the male are radically distinct from our common species, presumably *S. kompfi*, but although they closely approach the type possessed by *S. nimba*, as illustrated in Edwards' publication, there are several well-marked differences which serve to distinguish them. It is therefore proposed to describe the species as new.

It is of considerable interest to note that the photographs given by Costa Lima (1929) illustrating the terminalia of *Stethomyia* (very probably from Brazil but the exact source of origin is unknown) appear to represent yet another species. It is impossible to distinguish details, but from general appearances it approaches *S. nimba* as described by Edwards.

***Stethomyia lewisi*, new species.**

Adults: probably indistinguishable from *S. nimba* on the basis of adult characters (at least from the specimens we have from Pará which may be the true *nimba*). However, it is fairly easily distinguishable from *S. kompfi* by the long silvery-white scale-like setae which project far forward and overhang the large basal antennal joints (in *kompfi* these setae are normal and not grouped together, the white spot at the vertex of the head being composed chiefly of scales); by the three white lines of the mesonotum being strongly defined (the lateral ones in *kompfi* are rather indefinite); and by the presence of one or two prealar setae (absent in *kompfi*).

Male terminalia: Similar to *S. nimba* in having the strong spine remote from the base of the side-piece (it being at the same level as the internal spine) and in having the clasper distinctly longer than the side-piece. They differ from the *nimba* type chiefly in the structure of the claspette. Plate 10 shows figures of the three species whereby direct comparisons may be made.

The obvious differences are: The more elongate condition of the larger arm of the claspette (short and broad in *nimbus*), the elongate and trough-like intermediate arm (broad with an inner point in *nimbus*), and the shorter and stouter spine of the inner arm.

Figure 2 gives the normal dorsal aspect of the left processes of the claspette and the internal lateral aspect of the right side.

Costa Lima speaks of the ostrich-head-like appearance of the large arms of the claspette (the outline is reproduced in figure 12). These bear a general resemblance to the corresponding arms in *nimbus* as illustrated by Edwards (reproduced in figures 10 and 11).

Male holotype and female allotype to be deposited in the U. S. National Museum. One female paratype.

Type locality: Rio Cururipe (near the city of Salvador), Bahia, Brazil.

Named in honor of Dr. Paul A. Lewis.

VII. THE LARVA OF *SABETHES CYANEUS* (Fabricius), 1805.

Dyar (1928) states that a specimen of *Sabethes cyaneus* was bred from a tree-hole in Panama, but no larvae were obtained.

The only larva known for the genus is that of *S. bipartipes* Dyar and Knab. This is described as having the air-tube conically tapered, densely spicular, with a few weak hairs; lateral comb on a narrow transverse plate. Found in tree holes and fallen banana leaves.

Davis, while at Pará (April, 1930), obtained larvae of *cyaneus* from bamboos from which a male and three females were reared.

The larva differs from that of *bipartipes* chiefly in having the comb-scales separated.

It is of interest to note that, although the genus *Sabethes* apparently has been derived from *Sabethoides*, the larvae of the two *Sabethes* now known in the larval stage lack the dorsal hooks on the seventh segment, which, as far as is known, are unique to the genus *Sabethoides*.

Plate 11 gives the larval characters (figures 1, 2 and 3) and the genitalic characters (figures 4-7).

ACKNOWLEDGMENT.

The writer is pleased to take this opportunity to thank Dr. Nelson C. Davis for his assistance in the course of this work.

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1930. Observations on the Anophelini of Bahia, Brazil. Ann. Ent. Soc. America, 23: 467-492, Plates I-VII.

LIST OF PLATES AND FIGURES.

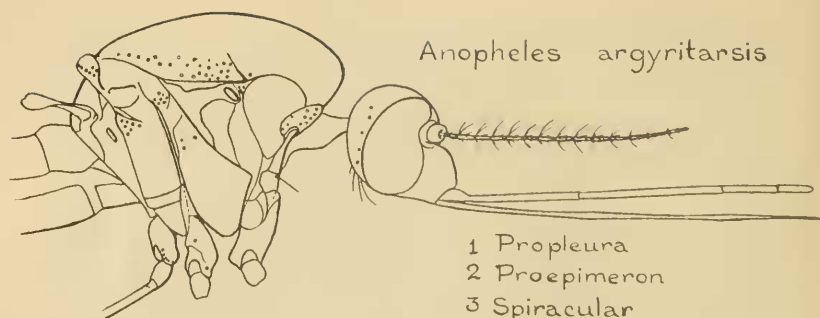
Plates 5, 6, and 7. Figures of representatives of various genera to show the general form of the head, development of clypeus, distribution of thoracic setae, size of the hind coxa and its relation to the meso-merocoxa. Also the wing venation of *Uranotaenia geometrica*.

Plate 8. Wings of *Mansonia fasciolata* and *Aedes taeniorhynchus*, to show the development of the scales on the sixth vein. Also the comb scales of the larvae of various species of *Aedes*.

Plate 9. Terminalia of *Mansonia lynchi* n. sp. and *M. arribalzagae* Th.

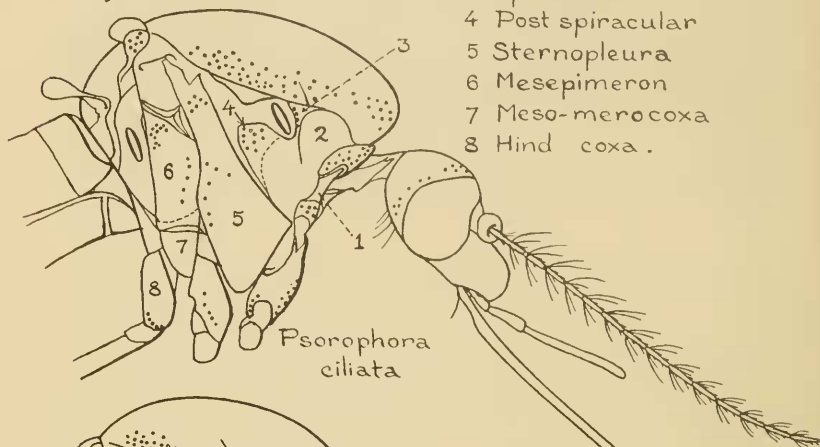
Plate 10. Comparison of the terminalia of the species of *Stethomyia* (*Anopheles*).

Plate 11. Larval and terminalia details of *Sabethes cyaneus*.

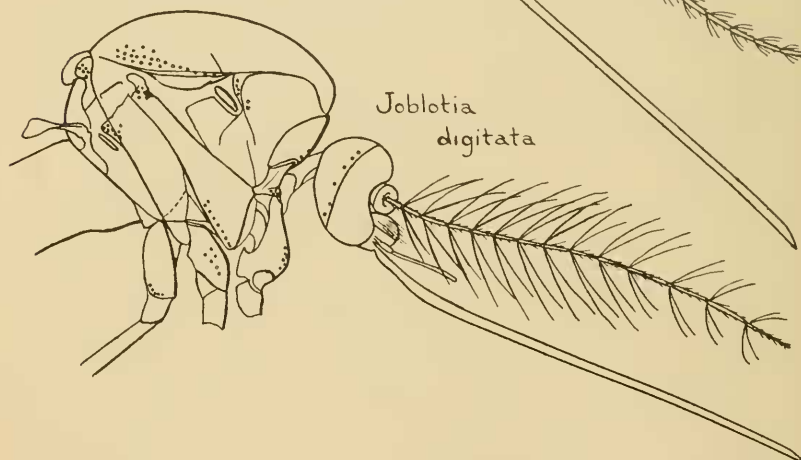


Anopheles argyritarsis

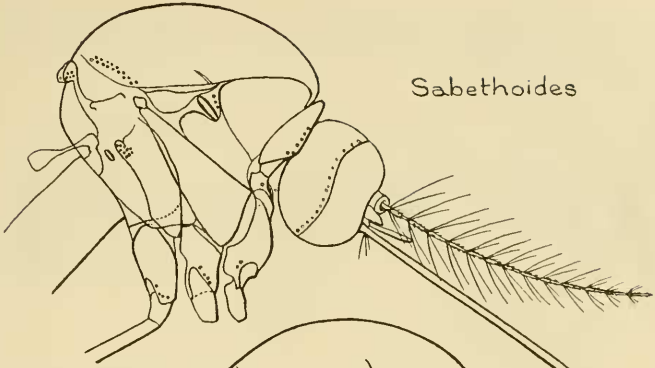
- 1 Propodeum
- 2 Proepimeron
- 3 Spiracular
- 4 Post spiracular
- 5 Sternopleura
- 6 Mesepimeron
- 7 Meso-merocoxa
- 8 Hind coxa.



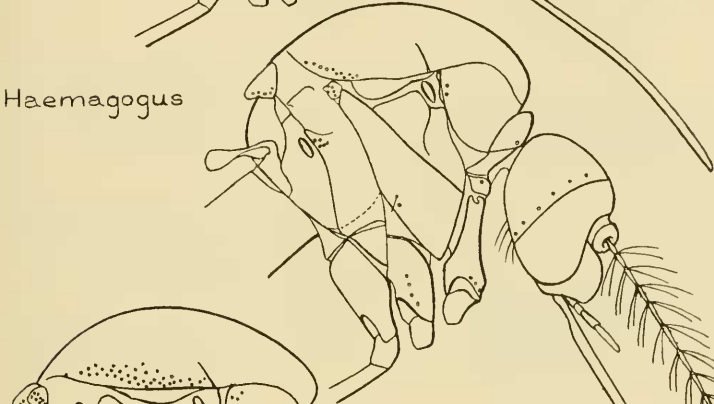
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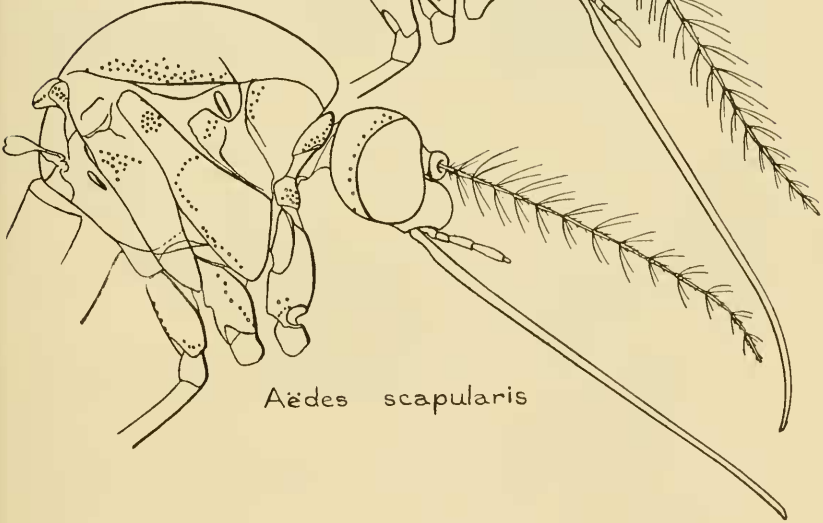
Joblotia digitata



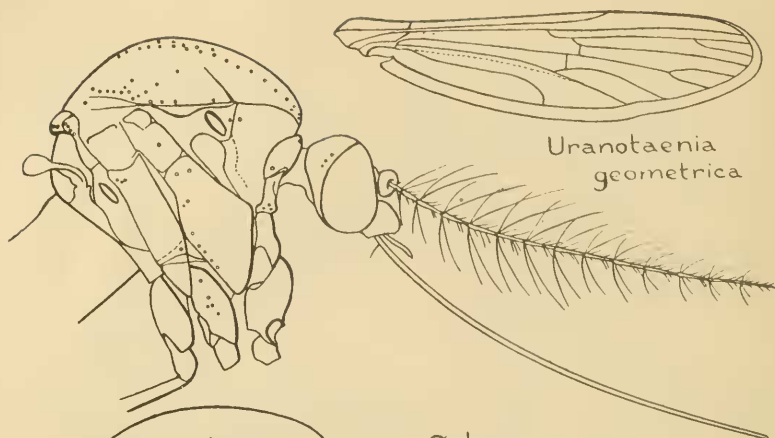
Sabethoides



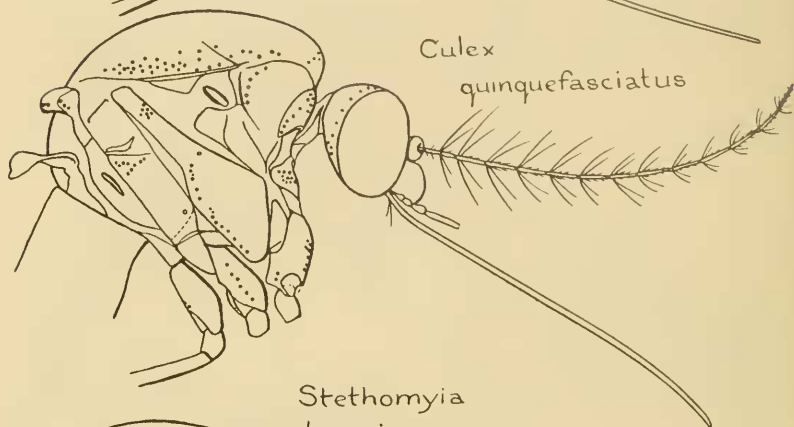
Haemagogus



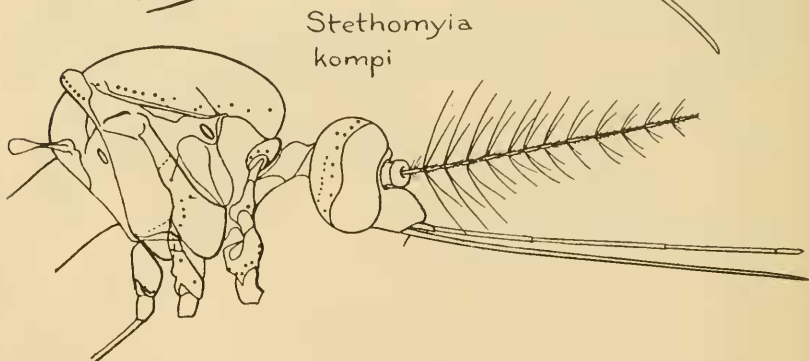
Aedes scapularis



*Uranotaenia
geometrica*



*Culex
quinquefasciatus*



*Stethomyia
kompi*

N. Cerqueira.

A. taeniorhynchus



A. aegypti



A. scapularis



A. fulvithorax



A. serratus



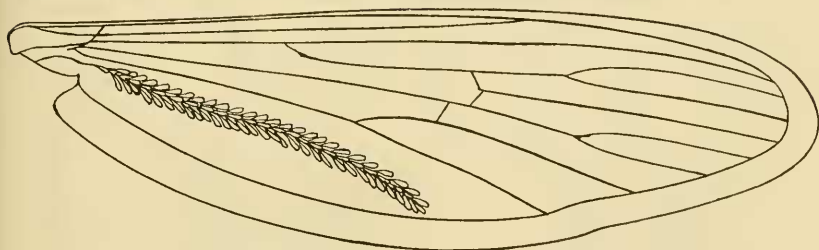
A. terreus



A. hastatus



A. fluviatilis



Mansonia fasciolata

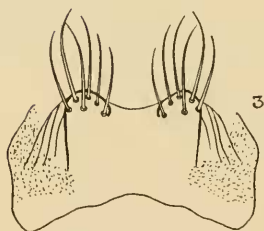
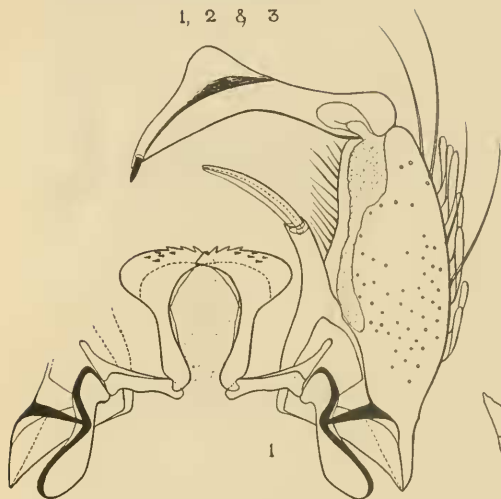


Aedes taeniorhynchus

N. Cergueira.

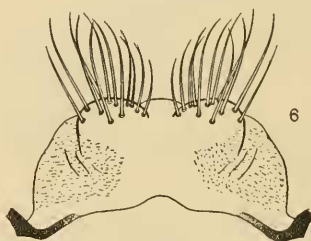
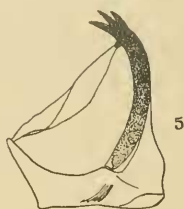
Mansonia lynchi Shn.

1, 2 & 3



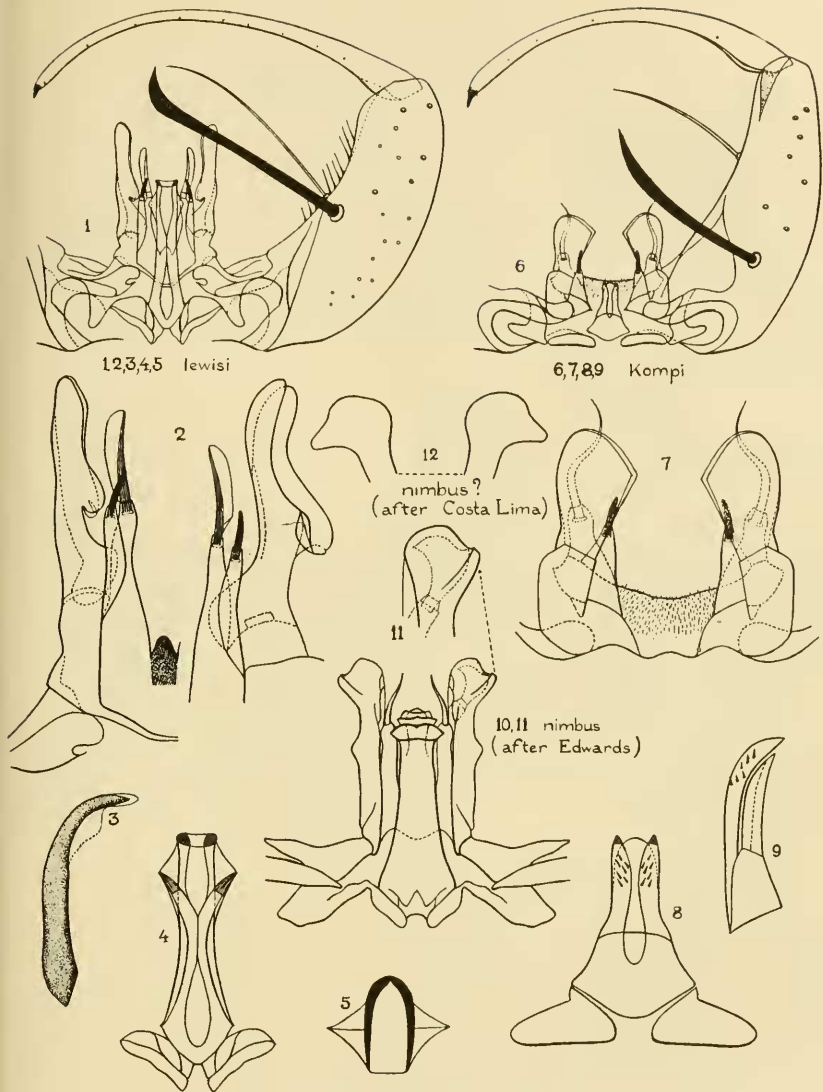
M. arribalzagai Th.

4, 5 & 6



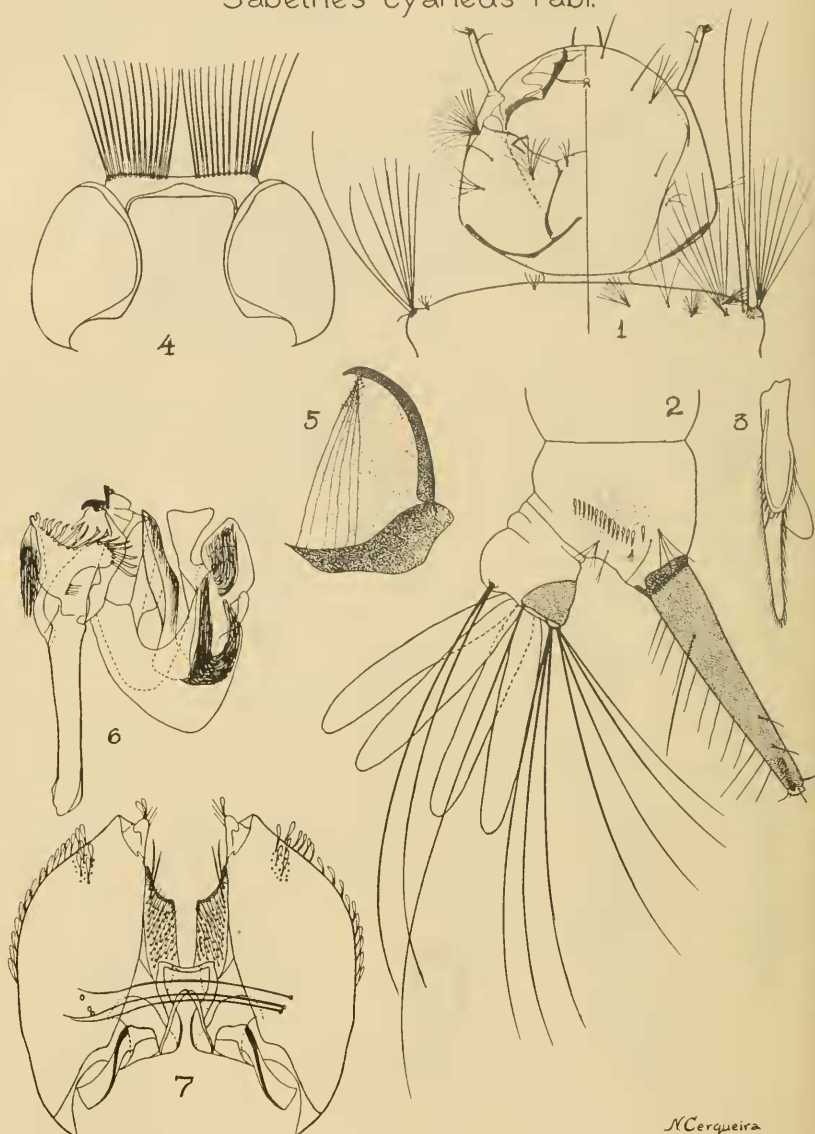
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YFL Bahia Braz Sept 1930
N Cerqueira.

Sabethes cyaneus Fabr.



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